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Origin of the sheeted dykes from the Kızıldağ (Hatay) ophiolite, Turkey

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Abstract

The Kızıldağ ophiolite in the Eastern Mediterranean region is characterized by a complete oceanic lithospheric remnants of the Southern Neotethys. A well-preserved ophiolite pseudostratigraphy and the lack of evidence for any signi®cant emplacement-related tectonic deformation in the Kızıldağ ophiolite suggest that it did not experience any large-scale tectonic transport from its original igneous environment (Robertson, 1986; Dilek and Delaloye, 1992; Dilek and Thy, 1998). Therefore, the Kızıldağ ophiolite is one of the best examples in which to observe structural evidence of sea-floor spreading tectonics and structural processes. It displays a complete ophiolite assemblage that comprises, from bottom to top, depleted mantle tectonites, ultramafic to mafic cumulates, isotropic gabbro, sheeted dykes, plagiogranites and a volcanic complex (Figure 1) (Selçuk, 1981). The Kızıldağ (Hatay) ophiolite formed in a suprasubduction zone setting during late Cretaceous (Bağcı et al., 2005, 2008; Dilek and Thy, 2009; Karaoğlan et al., 2013a, b).

Detailed field and laboratory studies were carried out on the sheeted dyke complex along Mediterranean coastline in Çevlik-Samandağ (Hatay) region. Twelve stations were defined in order to better understand internal structure, cross-cutting relations and geochemical groups of sheeted dykes that are interpreted as evidence of sea-floor spreading. Individual dykes in the sheeted dyke complex range in thickness from 0.5 cm to 100 cm and includes number of gabbroic screens. The orientations of the sheeted dykes in first eight stations are generally N75-85W/60-75NE and locally N85E/75NW. For the last four stations they display N69-77W/78SW and N35-60E/65-80SE due to local neotectonic effects. The dykes are petrographically represented by diabase, microdiorite and quartz microdiorite whereas the gabbroic screens are represented by gabro and diorite. At least three different dyke generations are observed on the basis of the cross-cutting relations (Figure 2).

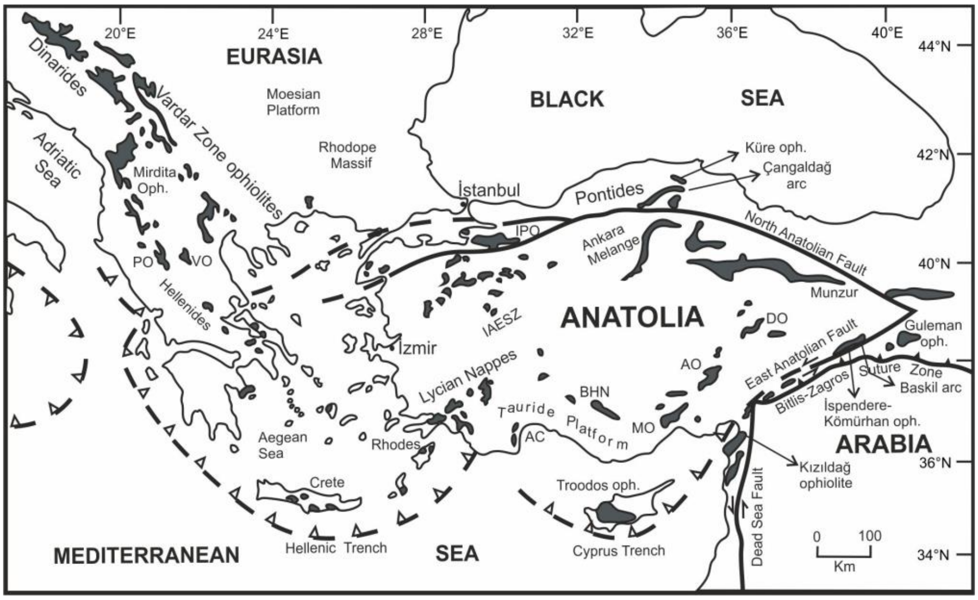

Figure 1. Distribution of the Neotethyan ophiolites in the eastern Mediterranean region (from Robertson, 2002).

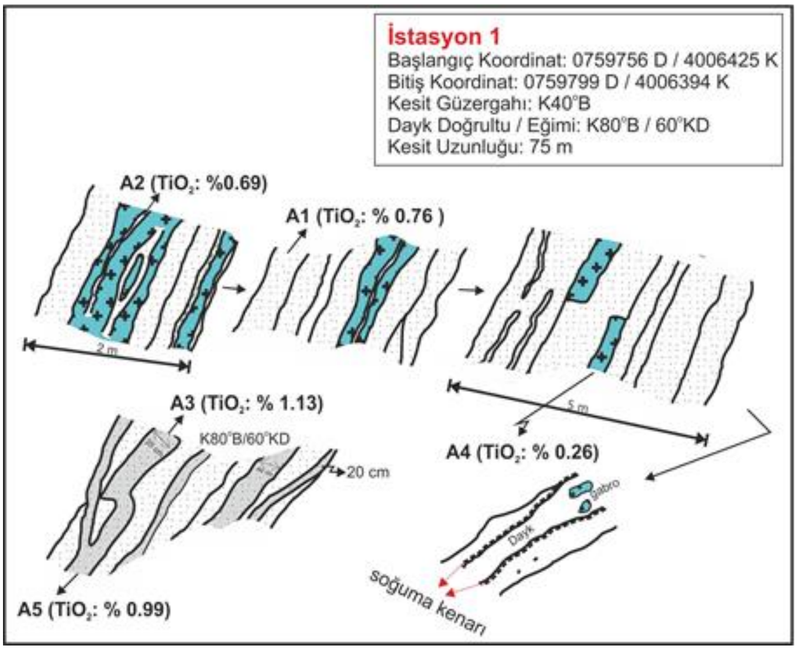

Figure 2. Representative sketch for the field relations of underlying isotropic gabbro and sheeted dykes.

The geochemistry of dykes suggests that they were derived from a tholeiitic magma. Four different geochemical groups were defined based on their TiO_2 (0.26 to 1.23 %) and Zr (16 to 49 ppm) contents (Figure 3). Chilling margin statistics in the sheeted dykes show mainly north-directed chilled margins althought south-directed and north/south-directed chilled margins are also seen (Figure 4, 5). This may suggest that the Kızıldağ (Hatay) ophiolite was formed in the northern part of an approximately E-W trending Neotethyan spreading ridge on the basis of present day geographic position. According to paleomagnetic studies, the initial orientation of Kızıldağ (Hatay) sheeted dykes and hence the associated spreading axis are suggested as 020º (Inwood et al., 2009). When the chilling margins are restored it is clearly seen that the oceanic crust of the Kızıldağ (Hatay) ophiolite was derived from the E-SE part of an approximately 020º trending Neotethyan spreading ridge. All the evidence suggest complex spreading geometries and different magma generations contemporaneously occured in a fore-arc tectonic setting in the Southern Neotethys during the late Cretaceous, similar to present-day marginal basins.

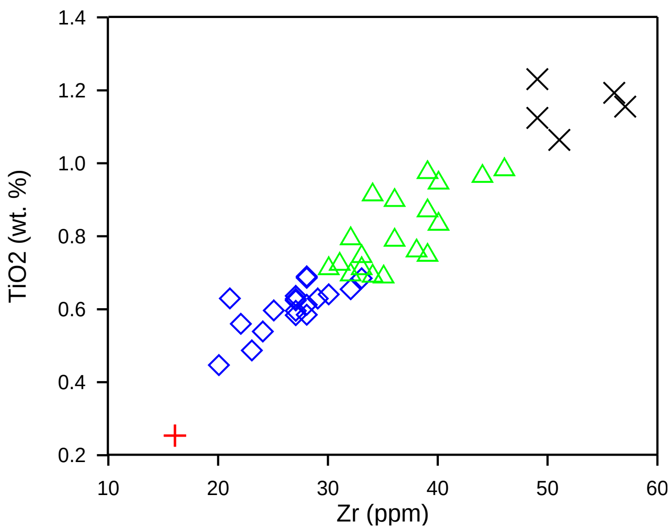

Figure 3. Zr vs TiO_2 diagram showing distinct dyke generations in the sheeted dykes of the Kızıldağ (Hatay) ophiolite.

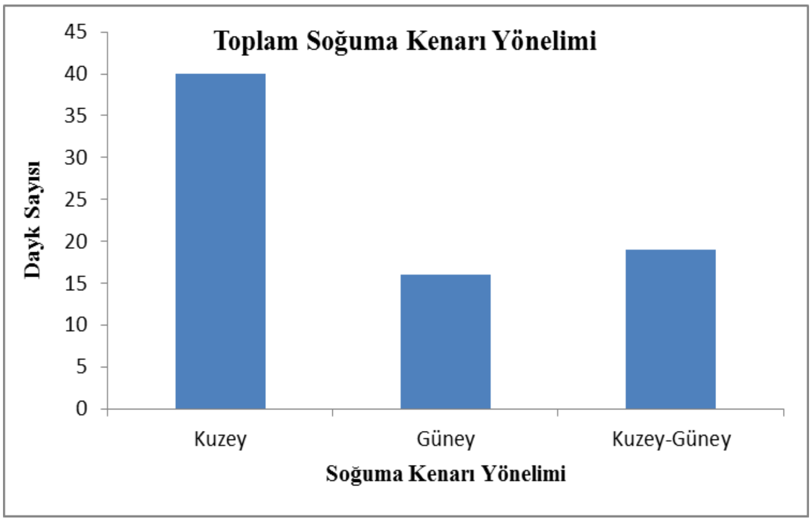

Figure 4. Chilling margin directions of the dykes studied in the Kızıldağ (Hatay) ophiolites.

Figure 5. (a) relations of sheeted dykes and the underlying gabbro, (b) well-developed sheeted dykes, (c) gabbro screens in sheeted dykes and (d) well-developed chilling margins of a dyke in sheeted dykes.

Keywords: Kızıldağ, ophiolite, sheeted dyke, chilled margin, geochemistry

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